TECHNICAL SUPPLEMENT DOCUMENT
FOR
PREVENTION OF SIGNIFICANT DETERIORATION
PERMIT NO. PSD-04-01
AGRIUM U.S. INC.
KENNEWICK, WASHINGTON
JULY 25, 2004

1.0 INTRODUCTION

1.1 THE PSD PROCESS

The Prevention of Significant Deterioration (PSD) procedure is established in Code of Federal Regulations (CFR), Title 40, Part 52.21 and in Washington State regulations, WAC 173-400-141. Federal rules require PSD review for all proposed construction of new air pollution sources or modification of existing air pollution sources that meet certain overall size, and pollution rate criteria. The objective of the PSD program is to prevent serious adverse environmental impact from emissions into the atmosphere by a proposed new or modified source. PSD rules require that an applicant use the most effective air pollution control equipment and procedures after considering environmental, economic, and energy factors. The program sets up a mechanism for evaluating and controlling air emissions from a proposed source to minimize the impacts on air quality, visibility, soils, and vegetation.

The Environmental Protection Agency delegated the authority to implement the PSD program described in title CFR 40 Part 52.21 and its supporting guidance and procedures documents to the Engineering and Technical Services staff[1] of the Air Quality Program of the Washington State Department of Ecology.

1.2 THE PROJECT

1.2.1 Location

Agrium U.S. Inc. (Agrium) owns and operates a nitrogen-based fertilizer plant in Kennewick, Washington: the Kennewick Fertilizer Operations (KFO). The plant makes or has the ability to make nitric acid (HNO_3), urea ammonium nitrate(trade name UAN-32), ammonia (NH_3), granulated ammonium nitrate (NH_4NO_3, trade name GAN), and calcium ammonium nitrate (trade name CAN-17). Agrium proposes to install emission controls in KFO to satisfy obligations required under a United States Environmental Protection Agency (EPA) compliance order (EPA Docket No. CAA-10-2003-0108, September 24, 2003).

KFO occupies three non-contiguous areas, about 6.5 kilometers (km) southeast of the Richland-Kennewick-Pasco area, each east of and adjacent to the Columbia River:

- The Hedges Area is 2.4 km north-northeast of the community of Finley, Washington.

[1] Units in the Technical Services Section

UTM Easting: 343420
Northing: 5115160
Longitude: -119.0285
Latitude: 46.1732

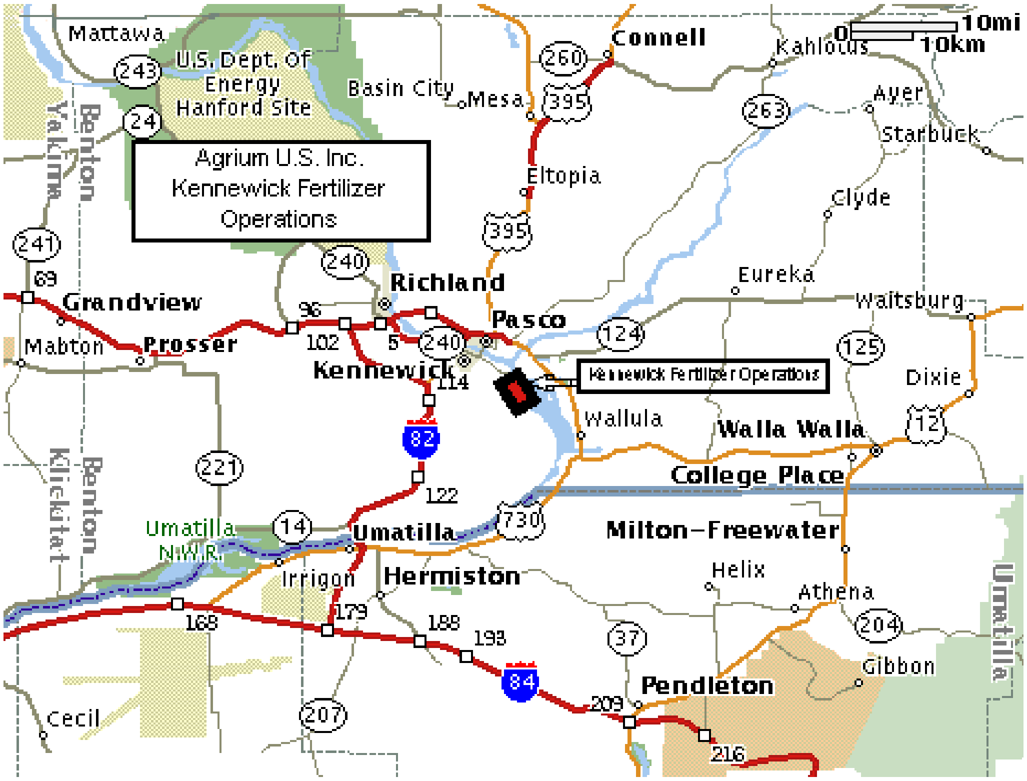
- The Kennewick Area is about 1.6 km southeast of the Hedges Area.

UTM Easting: 344250
Northing: 5114300
Longitude: -119.0227
Latitude: 46.1678

- The Finley Area is about one km southeast of the Kennewick Area, and about 1.8 km northeast of Finley, Washington.

UTM Easting: 344900
Northing: 5113100
Longitude: -119.011
Latitude: 46.1551

KFO is located within the Wallula PM_{10} (particulate matter less than 10 microns in aerodynamic diameter) nonattainment area. This is a Class II area that straddles the Columbia River from just west of Hedges and Finley to just east of Reese and just north of Burbank and Humorist to an east-west line between Wallula Junction and Port Kelley. The area is currently designated in attainment or unclassified for all other national and state air quality standards (NAAQS). KFO is about 25 km of the Washington-Oregon border, about 175 km from the Washington-Idaho border, and 55 km from the Yakama Tribal Nation.



1.2.2 Fertilizer Manufacturing Processes

Nitric acid is made by oxidizing NH_3 in the presence of a platinum/rhodium catalyst to form nitrogen dioxide (NO_2) which is then hydrolyzed to aqueous HNO_3. The finished aqueous product is between 56% and 60% HNO_3 by weight. The hydrolysis process takes place in an absorption column. Unabsorbed NO_2 is the source of nitric acid process NO_X emissions.

In Plant 8, nitric acid is used at any given time to make either UAN-32 or CAN-17. UAN-32 is a aqueous nitrous fertilizer formed by neutralizing nitric acid with NH_3 and mixing in urea. CAN-17 is an aqueous nitrous fertilizer formed by neutralizing nitric acid with crushed limestone and NH_3 in a two-step process. UAN-32 uses the same equipment required by CAN-17's second step. Consequently, UAN-32 and CAN-17 cannot be produced at the same time. The initial mixing of nitric acid with crushed limestone in the production of CAN-17 results in NO_X emissions by trace oxidation and/or NO_X evaporation/entrainment mechanisms.

In Plant 10, nitric acid is neutralized NH_3. The resulting aqueous NH_4NO_3 solution is concentrated by evaporation, and pelletized to granular form through a spray drum granulator. The exhaust from the granulator is passed through a wet scrubber and mist eliminator to remove entrained particles of granular NH_4NO_3. Entrained granular NH_4NO_3 not captured by the scrubber/mist eliminator is a source of particulate matter (PM) emissions from Plant 10.

1.2.3 KFO's Air Pollutant Emissions Sources

- Plant 7, nitric acid production: NO_X

- Plant 8, liquid nitrous fertilizer production: NO_X
- Plant 9, nitric acid production: NO_X
- Plant 10 granular nitrous fertilizer production: PM

1.3 PSD APPLICABILITY

KFO is a “major source”, as defined in PSD regulations (CFR 40 Part 52.21(b)(1)(i)(*a*)) because it is a nitric acid production facility, and has the potential to emit more than 100 tons per year (TPY) each of NO_X and PM. Both are pollutants that are subject to the federal Clean Air Act. Therefore, emission increases of each regulated pollutant from the facility resulting from new construction or modifications must be compared to the corresponding PSD significant emission rate (SER) threshold in order to determine if major new source review is required. Any criteria pollutant expected to have an emissions increase in excess of its SER threshold is subject to PSD permitting.

On April 27, 2004, Agrium submitted an application for a Prevention of Significant Deterioration (PSD) permit intended to consolidate terms and conditions for approval of historical projects outlined in EPA Docket No. CAA-10-2003-0108. On May 27, 2004, Ecology notified Agrium that the original application was found to be sufficiently complete to begin development of the PSD permit. The emissions increases associated with this project as proposed by Agrium and corresponding SER thresholds are shown in Table 1, below:

Table 1: Emissions Increases from KFO

KFO Net Emissions Increases from Consolidated Projects							
Emissions unit	**Pre-construction**		**Post-construction**			**Post-permit**	
	Actual emissions, tons per year (TPY)	**Basis period**	**Actual emissions, TPY**	**Basis period**	**Actual net emissions increase, TPY**	**Potential to emit (PTE), TPY**	**Net emissions increase, TPY**
Plant 7 NO_X	653.5	'91/'92	937, immediate post-construction	'94/'95	283.5	26.7	-626.8
			1,121, maximum post-construction	'94/'95	467.5		

KFO Net Emissions Increases from Consolidated Projects							
Emissions unit	**Pre-construction**		**Post-construction**			**Post-permit**	
	Actual emissions, tons per year (TPY)	**Basis period**	**Actual emissions, TPY**	**Basis period**	**Actual net emissions increase, TPY**	**Potential to emit (PTE), TPY**	**Net emissions increase, TPY**
Plant 8 NO_X	0	'90/'91	16.5, immediate post-construction	'93/'94	16.5	5	5
			18.4, maximum post-construction	'96/'97	18.4		
Plant 9 NO_X	94	'82/'83	136, immediate post-construction	'84/'85	42	46.6	-47.4
			290.5, maximum post-construction	'98/'99	196.5		

KFO Net Emissions Increases from Consolidated Projects							
Emissions unit	**Pre-construction**		**Post-construction**			**Post-permit**	
	Actual emissions, tons per year (TPY)	**Basis period**	**Actual emissions, TPY**	**Basis period**	**Actual net emissions increase, TPY**	**Potential to emit (PTE), TPY**	**Net emissions increase, TPY**
Plant 10 PM_{10}	7.1	'94/'95	10.4, PTE of modification	Pre-permit PTE	3.3	9.2	2.1
Plant 10 PM	77	'94/'95	87.1, immediate post-construction	'96/'97	10.1	99.7	22.7
			89.7, maximum post-construction, pre-permit	'97/'98	12.7		
			113.2, PTE of modification	Pre-permit PTE	36.2		
Total consolidated projects	Immediate post-construction net emissions increase, TPY			342 NO_X		Post-permit	-669.2 NO_X
				10.1 PM			
	Maximum post-construction net emissions increase, TPY			682.4 NO_X			22.7 PM
				12.7 PM			

As shown in Table 1, KFO is subject to major new source review (NSR) under PSD rules for NO_X emissions because actual net emissions increases were greater than the respective significant emissions rates (SER). Plant 10 never actually exceeded the PM-SER after the relevant modification, although it had the potential to do so. Agrium is also requesting a federally enforceable PM-limit that would constrain Plant 10 from exceeding the relevant SER. The Plant 10 modification could be eliminated from inclusion in this PSD permit on that basis[2]. However, Agrium requested that the PM limits proposed by Agrium for Plant 10 be included as terms in the PSD permit[3]. Control of all other regulated pollutants having increases in emissions resulting from the projects that are subject to this PSD permit will be included in the notice of construction approval to be

[2] USEPA guidance memo: "Appropriate Injunctive Relief for Violations of Major New Source Review Requirements," Eric V. Schaeffer, Director Office of Regulatory Enforcement (November 27, 1998)
[3] Electronic message from Rod Gilge (Agrium) to Bernard Brady (Ecology), June 3, 2004.

issued separately under the jurisdiction and authority of the Benton Clean Air Authority (BCAA). If this permit is approved by Ecology, its conditions will be enforced by BCAA in conjunction with other applicable regulations.

1.4 NEW SOURCE PERFORMANCE STANDARDS

The United States Environmental Protection Agency (EPA) has established performance standards for a number of air pollution sources in CFR 40 Part 60. These "New Source Performance Standards" (NSPS) represent a minimum level of control that is required on a new source. Emissions of NO_X to ambient air from nitric acid manufacturing are regulated by the New Source Performance Standards under CFR 40 Part 60 Subpart G - Standards of Performance for Nitric Acid Plants. KFO's nitric acid Plant 9 is subject to the requirements under Section 60.70. This limits NO_X emissions from the facility to 3.0 lbs/ton of nitric acid produced (lb NO_X/T_{acid}) as measured by the USEPA Method 7 test. The limit proposed for NO_X emissions from KFO's nitric acid Plant 9 is 0.3 lb NO_X/T_{acid}. This is more restrictive than the limit required under 40 CFR Part 60.70. There are no NSPS requirements for other pollutant emissions or processes in nitric acid manufacturing.

1.5 STATE REGULATIONS

KFO is subject to Notice of Construction requirements under Ecology regulations, Chapters 173-400 and 173-460 WAC.

2.0 DETERMINATION OF BEST AVAILABLE CONTROL TECHNOLOGY

2.1 DEFINITION and POLICY CONCERNING BACT

All new sources are required to use Best Available Control Technology (BACT). BACT is defined as an emissions limitation based on the maximum degree of reduction for each pollutant subject to regulation, emitted from any proposed major stationary source or major modification, on a case-by-case basis, taking into account cost effectiveness, economic, energy, environmental and other impacts (CFR 40 52.21(b)(12)).

The "top down" BACT process starts by considering the most stringent form of emissions reduction technology possible, then analyzing all reasonably available information to determine whether the related control method is technically feasible and economically justifiable[4]. If proven technically infeasible or economically unjustifiable, then the next most stringent level of reduction is considered in the same manner. The most stringent emission reduction (lowest emission level) that can be achieved by at least one control technology that is technically feasible and economically justifiable is determined to be BACT. The emission level and its related control technology are usually interchangeably referred to as the "BACT" of the permit decision. However, only the emission level is mandated in the permit. The source is generally free to apply any control technology with the requirement that it demonstrate BACT-level performance capability and not have unacceptable collateral environmental impacts.

[4] Other factors are also subject to consideration, e.g., energy consumption (regardless of short-term unit cost of the energy source) and local/regional community values. However, these are rarely considered in such a manner that would trump technical feasibility and economic justifiability.

2.1.1 Technical Feasibility

Frequently, a PSD applicant will propose that a given emission control technology is infeasible for the proposed new source or modification unless it has been previously used in exactly the situation under consideration. This is insufficient evidence to conclude that the control technology is technically infeasible. EPA's new source review guidance[5] suggests, "The control alternatives should include not only existing controls for the source category in question, but also (through technology transfer) controls applied to similar source categories and gas streams." EPA guidance also indicates that in order for such a "technology transfer" to be judged technically feasible, its application should be relatively seamless and free of technical speculation[6]. In the BACT determination for this permit, technical feasibility was judged subject to the following criteria:

- The control technology was previously applied to emission streams sufficiently similar to the one being proposed[7]. Any differences from the previous applications should not impact the control technology performance. The control technology and emission limit should not cause deterioration of the related process equipment, or irretrievably affect product quality.
- The emission limit associated with the BACT determination, including consideration for normal and reasonable control variability, was shown to be consistently achievable under normal and conscientious operating practices[8].
- It is not in the interests of the source, the regulatory agency, or the general public to set emission limits that will result in frequent violations even though the control technology was well-designed and installed and conscientiously operated by the source. Such situations increase costs to the source and regulatory agency (and consequently the public) for investigation, litigation, and reconstruction without benefit to the environment.

2.1.2 Economic Justifiability

"Economic justifiability" does not mean "affordable by the source."[9] Nor does it mean the most any other source in the world has spent on air pollutant emissions control. In the BACT determination for this permit, economic justifiability was judged subject to the following criteria[10]:

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[5] USEPA New Source Review Workshop Manual, Chapter B §IIIA (October, 1990)

[6] Court Decision on Steel Dynamics, Inc., PSD Appeals 99-04 and 99-05 before the USEPA Appeals Board (June 22, 2000)

[7] USEPA NSR Workshop Manual (1990), §IV.A.: "Add-on controls … should be considered based on the physical and chemical characteristics of the pollutant-bearing stream. Thus, candidate add-on controls (are those that) may have been applied to … emission unit types that are similar, insofar as emissions characteristics, to the emissions unit undergoing BACT review."

[8] USEPA NSR Workshop Manual (1990), §IV.A.1: "Technologies which have not yet been applied to (or permitted for) full scale operations need not be considered available …" and USEPA NSR Workshop Manual (1990), §IV.C.2.: "… the applicant should use the most recent regulatory decisions and performance data for identifying the emissions performance level(s) to be evaluated …"

[9] USEPA NSR Workshop Manual (1990), §IV.D.2: "… applicants generally should not propose elimination of control alternatives on the basis of … affordability …"

[10] USEPA NSR Workshop Manual (1990), §IV.D.2.c

- In order to eliminate a BACT candidate on the basis of cost effectiveness, the cost must generally be disproportionately high for the applicant when compared to the cost of control for the pollutant in recent BACT determinations in the applicant's source category.
- A BACT candidate may also be eligible for elimination if it has been applied as BACT in only a very limited number of cases and there is a clear demarcation between the cost of that technology and control costs accepted as BACT in recent determinations in the applicant's source category.

2.2 KFO'S SOURCES REQUIRING BACT ANALYSIS

The emissions sources requiring BACT analysis are those previously described in Table 1.

2.3 NO_X EMISSIONS FROM NITRIC ACID PLANTS 7 AND 9

There are several processes that might be applied for controlling NO_X emissions from nitric acid manufacturing:

Table 2: BACT Candidates for NO_X Reduction from Nitric Acid Manufacturing

NO_X Reduction Process	NO_X Reduction Level	Exhaust NO_X concentration, parts per million dry volume basis (ppmdv)	Previous applications
Dry absorption	95-98%	2.7 to 9.3	Pilot tests on coal-fired boilers.
SCONOx™	90-95% (Combustion turbines)	2	Small natural gas-fired turbines.
Hydrogen peroxide (H_2O_2 injection to the absorption column	99%	20 (annual average)	NO_X removal from acid gas scrubbers. Proposed by Agrium as Innovative Technology alternative.
Molecular Sieve Adsorption	98%	50	None, but tested on nitric acid plants.
Selective Catalytic Reduction (SCR)	98%	50 to 150	Nitric acid plants.
	90-95%	2 to 5	Large natural gas-fired turbines.
Non-Selective Catalytic Reduction (NSCR)	98 %	75 NO_X 350 ppmdv CO	Nitric acid plants.
Urea Scrubbing	97%	100	None, but

NO_X Reduction Process	NO_X Reduction Level	Exhaust NO_X concentration, parts per million dry volume basis (ppmdv)	Previous applications
			intended for nitric acid plants.
Refrigerated Extended Absorption	95%	170	Nitric acid plants.
Caustic Scrubbing	94%	200	Nitric acid plants.
Ammonia Scrubbing	94%	209	None, but intended for nitric acid plants.

2.3.1.1 Dry absorption:

The only dry NO_X absorption technology of which Ecology is aware that is in the process of commercialization is the Pahlman Process[11]. The Pahlman Process uses a proprietary formulation of manganese dioxide to absorb NO_X and SO_2 in the form of.manganese nitrate [$Mn(NO_3)_2$] and manganese sulfate ($MnSO_4$). The manganese nitrate is regenerated to manganese dioxide in a proprietary process. Demonstration runs using a skid-mounted pilot unit at DTE Energy's River Road Plant (June, 2003) and Minnesota Power's Boswell Energy Center (January, 2004) showed a NO_X reduction of over 95% and a SO_2 reduction of over 99%. Because the Pahlman Process also claims to be able to remove mercury from combustion gasses, it is currently primarily being developed with the intent of application to coal-fired power plants. There have been no commercial applications yet in any industrial sector. While this appears to be a very interesting and promising NO_X control technology, **Ecology concludes dry NO_X absorption is not technically feasible for KFO**.

2.3.1.2 SCONOx™:

The SCONO$_X$™ NO_X control process consists of passing the exhaust combustion gasses across a solid reactant surface. SCONO$_X$™ reduces the NO_X by reacting it with potassium carbonate (K_2CO_3), and reducing the resulting potassium nitrate (KNO_3) with hydrogen to form N_2 (and regenerate the K_2CO_3). SCONO$_X$™ has been applied in practice only to small-to-medium sized electricity-generating gas turbines[12].EPA's Region I describes the SCONOx™ system's applicability as limited "to natural gas-fired combined cycle turbine(s) using water injection."[13] Because SCONO$_X$™ has had such

[11] Exclusive vendor: EnviroScrub Technologies Corporation, 1650 West 82nd Street, Suite 650, Minneapolis, MN 55431

[12] SCONO$_X$™ is a product of Goal Line Environmental Technologies, represented by Sunlaw Energy Corporation (Los Angeles, CA). The first commercial-size SCONOx system was installed in May 1995 at the Sunlaw-U.S. Growers 30-megawatt power plant in Vernon, CA. A second SCONOx unit, with improved economic and operational design, was installed in December 1996 at Sunlaw's other 30 megawatt power plant, Federal Cold Storage (This is not currently shown as an active site on the Goal Line web page, http://www.alstomenvironmental.com/sconox/). A SCONOx unit was installed on a 5-megawatt turbine in Andover, MA in 1998.

[13] http://www.epa.gov/region1/assistance/ceit_iti/tech_cos/goalline.html

limited application, it is very expensive compared to existing NO_X control processes, and relies for whatever attractiveness it may have on its ability to simultaneously remove carbon monoxide and volatile organic compounds. Neither of these pollutants is in nitric acid plant emissions. In addition, gas turbine exhaust NO_X concentrations are about one-tenth that of Plants 7's and 9's. **Ecology concludes that the nature of the emission stream from a nitric acid plant exhaust is insufficiently similar to the emission streams in previous SCONO$_X$™ applications for SCONO$_X$™ to be considered technically feasible for the proposed KFO**[14].

2.3.1.3 H_2O_2 injection to the absorption column:

Hydrogen peroxide (H_2O_2) has been demonstrated to enhance NO_X removal in gas scrubbers and is sold commercially for this application. In addition, some research in the past using lab scale equipment has shown that NO_X emissions can be reduced by the addition of H_2O_2 to nitric acid absorption columns.[15] The innovative technology proposed by Agrium is to use H_2O_2, in combination with a modified absorption process, to reduce NO_X emissions in a full scale, commercial nitric acid plant.

While H_2O_2 is being used by some companies on a short-term basis to control emissions during plant start-ups, Ecology is not aware of any HNO_3 plant currently using hydrogen peroxide to reduce NO_X emissions to BACT levels on a continuous basis. Review of the EPA's RACT/BACT/LAER database failed to locate any listings for the use of H_2O_2 for NO_X control in HNO_3 plants. Review of both California and Texas BACT determinations also did not identify any listings for the use of H_2O_2 in HNO_3 production.

In January 2004, Agrium performed trials in Plant 9 on this process that indicated it may be able to reduce NO_X emissions from HNO_3 production to a BACT-equivalent degree. Agrium proposed they be allowed to develop this control process under the provisions of 40 CFR 52.21(b)(19), Innovative Technology. Under these regulatory provisions, Agrium may be allowed up to 4 years from the date of startup of the NO_X emitting process or 7 years from the date of issuance of the PSD permit to achieve BACT-equivalent emission levels. If Agrium is unable to achieve BACT-equivalent emission levels within the allocated time allowed, Agrium must in any event achieve BACT-equivalent emission levels not later than three years after termination of the Innovative Technology allowance. Notwithstanding the maximum time allowed by regulation for Agrium to achieve BACT-equivalent emission levels, Ecology may terminate the Innovative Technology allowance if it concludes that the proposed system is unlikely to achieve the required level of control.

Ecology believes that the use of H_2O_2 combined with a modified absorption process (including recycling product acid to improve NO_X absorption) constitutes an Innovative Technology. Ecology has drafted terms in this PSD permit allowing the development of

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[14] USEPA New Source Review Workshop Manual (1990), §IV.A.: "Add-on controls … should be considered based on the physical and chemical characteristics of the pollutant-bearing stream. Thus, candidate add-on controls (are those that) may have been applied to … emission unit types that are similar, insofar as emissions characteristics, to the emissions unit undergoing BACT review."

[15] Thomas, D. and Vanderschuren, J, "The Absorption-Oxidation of NOx with Hydrogen Peroxide for the Treatment of Tail Gases," Chemical Engineering Science, Vol. 51, No. 11, pp. 2649-2654, 1996.

the H_2O_2 Innovative Technology for Plant 9 and relaxing NO_X emission limits from BACT-equivalency, but including benchmarks on which to gauge performance progress.

2.3.1.4 Molecular Sieve Adsorption:

Molecular Sieve Adsorption consists of adsorbing NO_X from a chilled tail gas exhaust stream onto selective adsorbent resin beads, desorbing the NO_X at a higher concentration than it had been in the original exhaust stream into a heated tail gas stream, and recycling the NO_X to the nitric acid process. In field studies, the adsorbent resin was destroyed by the humidity of the tail gas stream. There have never been any applications to full-size nitric acid plants, and research on this control technology has apparently been abandoned. **Ecology concludes Molecular Sieve Adsorption is not technically feasible for KFO**.

2.3.1.5 SCR:

SCR involves reacting NO_X with ammonia over a solid-phase catalytic bed. Excess ammonia is fed through the catalyst bed to push the NO_X reduction to the desired level. The excess ammonia leaves the system as "ammonia slip." Ammonia is a toxic air pollutant under 173-460 WAC, and contributes to visibility reduction and increased nitrogen deposition in Class I areas. However, it is not a criteria pollutant under PSD permitting.

Excepting combustion processes, SCR appears to be by far the most broadly applied NO_X control process, and is the state-of-the-art for nitric acid plants. KFO has been using SCR on both Plants 2 (to be shut down) and Plant 7 for several years, albeit not to BACT standards.

As can be seen in Table 2, the demonstrated NO_X reduction efficiency of SCR depends on the initial NO_X concentration in the exhaust stream to be treated. An untreated tail gas stream from a nitric acid plant will have a NO_X concentration between 2,200 and 4,400 ppmdv. An untreated exhaust stream from a natural gas-fired turbine with a low-NO_X burner will have a NO_X concentration between 9 and 25 ppmdv. Nonetheless, the demonstrated treated NO_X concentration from gas-fired turbine using SCR is substantially lower than from a nitric acid plant. In theory, it should be possible to reduce the NO_X concentration from any NO_X containing exhaust stream to the same level. In practice, this may be inhibited by physical limitations in the precision of the ammonia feedback control system and difficulty in achieving adequate mixing at the feed end of the catalyst bed. Design modifications of the catalyst bed and/or ammonia feed system might be able to improve this, but none have so far been demonstrated. Consequently, **Ecology concludes treated NO_X concentrations for nitric acid plant tail gas comparable to that from natural gas-fired turbines is not technically feasible for KFO**.

Notwithstanding Ecology's conclusion, above, Agrium proposed SCR be applied to Plants 7 and 9 to achieve annual average maximum NO_X concentrations of 35 ppmdv and 20 ppmdv, respectively. Both plants currently have partial NO_X control systems: Plant 7 uses nonselective catalytic reduction (described in the next section) and a small SCR system. Plant 9 uses refrigerated extended absorption (described in § 2.3.1.7). Agrium's proposed NO_X reduction from the currently treated levels for Plants 7 and 9 using SCR is 93% and 86%, respectively. Total NO_X control would be 99% and 99.4%, respectively.

This is a greater level of control than applied in any nitric acid plant of which Ecology is aware. **Ecology agrees with Agrium that this constitutes BACT for KFO.** The following discussion regarding non-selective catalytic reduction, urea scrubbing, and refrigerated extended absorption are included to clarify this conclusion.

2.3.1.6 Non-Selective Catalytic Reduction:

Non-Selective Catalytic Reduction (NSCR) involves partial combustion of a hydrocarbon fuel to first generate reaction heat followed by reaction of the hydrocarbon with NO_X to form elemental nitrogen and carbon dioxide. As in virtually all hydrocarbon combustion processes, some carbon monoxide (CO) is formed by incomplete combustion. High levels of NO_X reduction can be achieved by increasing the fuel concentration relative to the available oxygen. However, the CO concentration increases dramatically. To achieve NO_X reduction levels comparable to SCR, NSCR would result in CO emissions of 350 ppmdv or greater. Consequently, even though NSCR may be able to achieve a similar degree of NO_X reduction to SCR, this collateral pollutant CO emission is an undesirable consequence not experienced in the use of SCR. **Ecology concludes that the NSCR is not as effective a pollutant reduction technology as SCR**.

2.3.1.7 Urea Scrubbing:

Urea Scrubbing has not been demonstrated in practice, and may cause caking of granular ammonium nitrate (GAN) due to trace carryover of urea into the nitric acid. **Ecology concludes urea scrubbing is not technically feasible for KFO**.

2.3.1.8 Refrigerated Extended Absorption:

Refrigerated Extended Absorption (REA) may be considered to be a NO_X control process or simply a mechanism for improving nitric acid yield. In the simplest nitric acid plant design, the nitric acid is produced by absorbing NO_2 in water in an absorption column. REA simply feeds the chilled tail gas from the first column to a second absorption column. The practical limit for the NO_X concentration in the tail gas from the second column is in the neighborhood of that experienced by KFO. **Ecology concludes that the REA is not as effective a pollutant reduction technology as SCR**.

2.3.1.9 NO_X BACT Determination

All the remaining BACT candidates in Table 2 have a lower potential for NO_X removal from KFO's nitric acid plants than those discussed above, and will not be further considered. As noted in §2.3.1.4, Ecology agrees with Agrium that 35 ppmdv and 20 ppmdv treated NO_X concentrations from Plant 7 and Plant 9 constitute BACT.

2.4 NO_X EMISSIONS FROM PLANT 8

Ecology has been unable to find similar sources to Plant 8 with NO_X treatment systems. Hot combustion gases are the predominant subject for application of NO_X treatment systems. Plant 8's emission stream is only slightly greater than ambient in temperature. Assuming relatively seamless application of NO_X treatment systems for hot combustion gases to NO_X treatment for a (slightly above) room temperature vent-gas stream would be stretching the term "technology transfer." Ecology believes that heating the relatively small (3,000 scfm) Plant 8 vent gas stream to high enough temperatures to begin considering processes such as SCR is intuitively uneconomical. Nonetheless, Agrium installed such a system in its Idaho fertilizer plant on a process (not CAN-17) with an expected NO_X emission concentration almost 100 times higher than that expected from Plant 8[16]. Using the design of this treatment system as a template for potential application to Plant 8, Agrium calculated a BACT effectiveness cost of over $25,000/ton NO_X removed. Ecology agrees this is not economically justifiable.

A more common and generally applicable treatment process for acid gases is to scrub them through high alkalinity water. Because the expected exhaust stream form Plant 8 is relatively low in concentration and flow rate, it is not surprising that Agrium's BACT effectiveness cost analysis resulted in a figure over $70,000/ton NO_X removed. Ecology agrees this is not economically justifiable.

Finally, Agrium tested its own method for NO_X treatment: Use only nitric acid from Plant 9 and add urea to the existing venturi scrubber feed. Agrium found this to be 87% effective for NO_X removal, reducing potential NO_X emissions to 5 tons per year or less. **Agrium proposed and Ecology agrees that this is BACT for KFO's Plant 8.**

2.5 PM EMISSIONS FROM PLANT 10

Plant 10 has two sources of PM emissions: The ammonium nitrate granulator and the fluid bed cooler (FBC). Only the ammonium nitrate granulator was modified, and is subject to BACT determination.

Plant 10 currently uses a wet scrubber and mist eliminator to control particulate emissions from the ammonium nitrate granulator. Source tests at KFO[17] and USEPA data[18] indicate this system is operating at 99.9% efficiency for particulate removal. In principal, either a bag house or a wet electrostatic precipitator (wet ESP) might also be used. In general application, bag houses can operate at as high as 99.9% particulate removal. Wet ESPs are generally expected to operate between 90 and 99% particulate removal efficiency. Ecology knows of no application of either of these technologies to mist-borne fertilizer material particulate. Bag houses are generally infeasible when applied to moist particulate material because the cake rapidly blinds the filter material, and is difficult to shake or blow off the bags. Since a wet ESP is unlikely to reduce the ammonium nitrate granulator particulate emissions to a greater degree than the existing scrubber/mist eliminator, it will be given no further consideration. **Ecology agrees that the existing scrubber/mist eliminator is BACT for the ammonium nitrate granulator particulate emissions from Plant 10.**

Of Agrium's proposed 99.7 TPY PM emissions from Plant 10, about 75% would come from the FBC. As mentioned in § 1.3, Agrium's proposed 99.7 TPY PM emissions from Plant 10 constrains Plant 10 emissions such that new source review under PSD

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[16] Compared to using nitric acid from Plant 9. This gives lower emissions than using nitric acid from Plant 7. As will be discussed later, this permit will require that only Plant 9 nitric acid be used in CAN-17 production.

[17] "Agrium U.S., Inc. Plant #10 Particulate Matter Testing Kennewick, WA (May14-15, 2002), AMTEST Air Quality, LLC (Preston, WA) Report

[18] Compilation of Air Pollutant Emission Factors, "Volume I: Stationary Point and Area Sources," Table 8.3.2, "Emission Factors for Processes in Ammonium Nitrate Manufacturing Plants," Office of Air Quality Planning and Standards, Office of Air and Radiation, USEPA - Research Triangle Park, NC (January, 1995)

regulations is not triggered. Agrium proposed to use a hardening agent in the granular ammonium nitrate to minimize carryover of fines from the fluid bed cooler. Terms and conditions will be included in the PSD permit to require compliance with the proposed 99.7 TPY PM emissions from Plant 10.

3.0 AMBIENT AIR QUALITY ANALYSIS

3.1 REGULATED POLLUTANTS

PSD rules require an assessment of ambient air quality impacts from any facility emitting pollutants in significant quantities. Limiting increases in ambient pollutant concentrations to less than the maximum allowable increments prevents significant deterioration of air quality.

3.1.1 Modeling Methodology:

The dispersion modeling used three years of representative off-site meteorological data collected and approved for use by Ecology from Vista Airfield (1993, 1995 and 1996), and the Industrial Source Complex Short-term (ISCST3 version 02035) model was used to calculate ambient NO_x concentrations at all receptors.

3.1.2 Modeling Results:

Modeled maximum NO_X impacts resulting from this project were 0.425 micrograms per cubic meter ($\mu g/m^3$) for BACT-equivalent emission levels and 0.57 $\mu g/m^3$ for the highest emitting year projected under development of the H_2O_2 Innovative Technology. Both of these results are below the 1 $\mu g/m^3$ threshold for modeling significance. Consequently, no further analysis is required for ambient NO_X impacts.

As noted in §1.3, Plant 10 never actually exceeded the PM-SER after the relevant modification, and Agrium's proposed permit limit constrains Plant 10 PM emissions increase below the PM-SER. Consequently, no ambient air quality analysis is required under PSD regulations for PM emissions from Plant 10.

3.2 TOXIC AIR POLLUTANTS

PSD rules require the applicant to consider emissions of toxic air pollutants during the course of BACT analysis. One reason for this requirement is to ensure that the source does not employ an emission control technique that controls the main pollutant of concern, but emits a new toxic air pollutant in serious quantities. Ecology’s regulations (Chapter 173-460 WAC) require an ambient air quality analysis of TAP emissions. All NSR requirements pursuant to WAC 173-400-110 are addressed in detail by BCAA under notice of construction approval review. BCAA's review also fulfills the PSD review requirement. Agrium must perform adequate modeling to indicate acceptable impacts and use T-BACT. Acknowledgement by BCAA that Agrium has/will do so constitutes adequate consideration of TAPs impacts under this PSD permit.

4.0 OTHER AIR QUALITY RELATED ISSUES

4.0.1 Class II Area Impacts on Soils, Vegetation, and Animals:

According to the EPA's NSR guidance[19], for most types of soils and vegetation, ambient concentrations of criteria pollutants below the secondary national ambient air quality standards will not result in harmful effects. Since the maximum NO_X impacts for this project are below modeling significance, maximum ambient pollutant concentrations attributable to the proposed project may be safely assumed to be below the secondary national ambient air quality standard. Exceptions exist where particular species are sensitive to particular pollutants. No such sensitive species have been identified.

USEPA waived submittal of this permit action to Endangered Species Act consultation under 50 CFR Part 402 with the United States Department of Fish and Wildlife and the National Marine Fisheries Service. This permit consolidates considerations from existing modifications and reduces existing pollutant emission. Consequently, EPA concluded that no action under this permit was "likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat."[20] BCAA is lead agency in coordinating the State Environmental Protection Administration (SEPA) analysis. Because the projects subject to this permit are "historical" and overall pollutant emissions are dramatically reduced from pre-permit levels, Ecology believes a Determination of Non-Significance (DNS) will be issued. However, this permit cannot be final and effective until the DNS or a Final Environmental Impact Statement is issued pursuant to the SEPA review.

4.0.2 Class I Area Visibility Impact: Since NO_X is a long-distance impact consideration, and the net result of this project is a substantial reduction in past NO_X emissions, visibility will not be adversely affected in Class I areas as a result of this permit action.

4.03 Class I Area Deposition:

Since NO_X deposition is both a long-term and long-distance impact consideration, and the net result of this project is a substantial reduction in past NO_X emissions, NO_X deposition will be negative. Consequently, it is not a matter of concern.

4.3 CONSTRUCTION AND GROWTH IMPACTS

The PSD regulations require that a growth impact analysis be conducted for the project. Procedures for this analysis are described in the USEPA New Source Workshop Manual[21]. This permit action corrects the missing permit(s) for the existing manufacturing facility. Apart from construction traffic curing construction of the related control technologies, there is no construction or growth impact resulting from this project.

Ecology concludes that the proposed modifications will not cause excessive construction or growth related air quality impacts at or around KFO.

5.0 CONCLUSION

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[19] *op. cit.*, Chapter D, § IIC

[20] 40 CFR 50.402.10(a), and electronic message from Dan Meyer (EPA Region X) to Bernard Brady (Ecology), June 25, 2004

[21] Op. cit.

The project will have no significant adverse impact on air quality or air quality related values. The Washington State Department of Ecology finds that the applicant, Agrium, has satisfied all requirements for approval of a PSD permit for the proposed Agrium project.

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